Rearrangements of 8-Oxa-4-thia-1-azabicyclo[4,3,0]non-2-en-7-ones: a New Synthesis of 4-Thiazolines

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Summary The enethiolates, *e.g.* (**13**), formed from thiazino-oxazolidinones, *e.g.* (**9**), in the presence of potassium t-butoxide, are converted into 4-thiazolines *e.g.* (**15**), probably by an S_N2-like pathway.

As part of an exploration of the chemistry of β-amino-α-mercaptoacrylates, we have examined some β-elimination reactions of methyl 7-oxo-8-oxa-4-thia-1-azabicyclo[4,3,0]-non-2-ene-3-carboxylates.

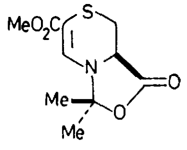
Treatment of the thiazino-oxazolidinone (**1**)[1] with $KOBu^t$ (1 mol. equiv.) in $[^2H_6]$dimethyl sulphoxide caused the rapid formation (n.m.r. spectroscopy) of the salt (**2**). Acidification of the mixture yielded the acid (**3**) as an unstable oil and addition of MeI to the mixture afforded the methyl ester (**4**)† (26% after silica-gel chromatography). Under similar conditions the dimethylthiazino-oxazolidinone (**8**)[2] gave the salt (**5**) which was converted into the unstable acid (**6**) and the methyl ester (**7**)† (62% after silica-gel chromatography). The acids (**3**) and (**6**) were decomposed to methyl 2,2-dimethyl-4-thiazoline-5-carboxylate (**10**)† during silica-gel chromatography.

When $KOBu^t$ (1 mol. equiv.) was added to a solution of the derivative (**1**) in dimethyl sulphoxide containing MeI, the methylthioacrylate (**11**)† was the major product (42% after silica-gel chromatography).

Evidently the foregoing reorganizations involve the intermediacy of the enethiolates, *e.g.* (**12**), formed by a β-elimination process. In principle, cleavage of the C–O bond of these intermediates may precede (S_N1-like) or be coupled with (S_N2-like) the attack by the thiolate anion. In an attempt to distinguish between these pathways, a thiazino-oxazolidinone possessing a chiral centre at position 9 was required. Treatment of the thiazine-carboxylic acid (**14**)[3] with redistilled MeCHO in $CDCl_3$ containing $MgSO_4$ afforded (90%) the derivative (**9**)†, m.p. 50—52°, $[\alpha]_D$ + 276° ($CHCl_3$), as a single diastereoisomer. When treated with $KOBu^t$ followed by acid, the thiazino-oxazolidinone (**9**) was transformed into the 4-thiazoline (**16**), which gave (33%) the salt (**17**),† m.p. 130—132°, $[\alpha]_D$ + 9° ($CHCl_3$), with t-butylamine. O.r.d. measurements {[Φ] + 13,800° (252), −160° (290), +4800° (333), and −4600° (382 nm) (EtOH)} confirmed that the salt (**17**) was optically active.

Although it is not possible to define the absolute stereochemistry or the optical purity of the 4-thiazoline (**17**), it is clear that chirality is maintained during the reorganization. This result implicates a S_N2-like process in the conversion of the enethiolate (**13**) into the salt (**15**).

These results exemplify an unusual molecular rearrangement which provides a novel synthesis of 4-thiazolines, a relatively unexplored class of compound.[4] There is some analogy for this behaviour in the triethylamine-induced conversion of 1,4-thiazepines, *e.g.* (**18**), into 1,3-thiazines, *e.g.* (**19**).[5]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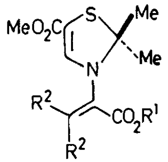
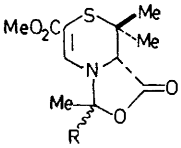
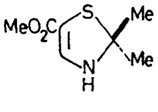

(2) R^1=K, R^2=H (5) R^1=K, R^2=Me
(3) R^1=R^2=H (6) R^1=H, R^2=Me
(4) R =Me, R =H (7) R^1=R^2=Me


(8) R = Me
(9) R = H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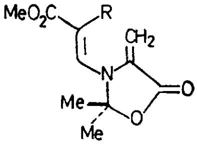
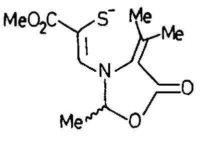
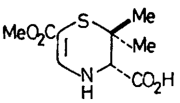
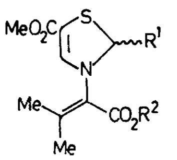
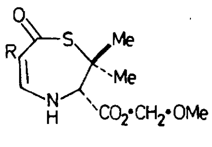
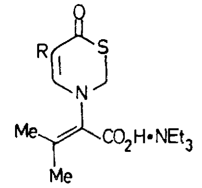

(11) R = MeS
(12) R = S^-


(13)


(14)


(15) R^1 = Me, R^2=K
(16) R^1 = Me, R^2=H
(17) R^1 = Me, R^2=$Bu^tNH_3^+$


(18) R = phthalimido


(19) R = phthalimido

We thank the S.R.C. for a research studentship (to A.G.W.B.).

(*Received, 10th January* 1975; *Com.* 031.)

† The composition of new compounds was confirmed by elemental analysis and/or by mass spectroscopy. Structural assignments were supported by i.r., u.v., and n.m.r. spectroscopic evidence.

[1] A. R. Dunn, I. McMillan, and R. J. Stoodley, *Tetrahedron*, 1968, **24**, 2895.

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